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Moderators of the Relation between Shyness and Behavior with Peers: Cortisol Dysregulation and Maternal Emotion Socialization

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Abstract

This study investigated the relations among shyness, physiological dysregulation, and maternal emotion socialization in predicting children's social behavior with peers during the kindergarten year (n = 66; 29 girls). For shy children, interactions with peers represent potential stressors that can elicit negative emotion and physiological reactions. Behavior during these contexts can be viewed as adaptive (e.g., playing alone) or maladaptive (e.g., watching other children play without joining in) attempts to regulate the ensuing distress. Whether shy children employ adaptive or maladaptive regulatory behaviors was expected to depend on two aspects of emotion regulatory skill: (1) children's physiological regulation and (2) maternal emotion socialization. Findings supported the hypotheses. Specifically, shy children with poorer cortisol regulation or mothers who endorsed a higher level of non-supportive emotion reactions engaged in more maladaptive play behaviors, whereas shy children with better cortisol regulation or a high level of supportive maternal emotion reactions engaged in more adaptive play behaviors.

Keywords

Cortisol; shyness; peer relations; emotion socialization; emotion regulation strategies

Children may refrain from interacting with others for multiple reasons (e.g., shyness or social disinterest), and these varying motivations are captured by the umbrella term social withdrawal. As children begin formal schooling, interactions with peers and the social contexts afforded by meeting new friends typically become more common. For shy children in particular, such situations represent potential stressors. In the present investigation, we define shyness using Coplan and colleagues' definition of conflicted shyness— a type of social withdrawal characterized by anxiety and social trepidation *in spite of a desire to interact socially* (Coplan, Prakash, O'Neil, & Armer, 2004; see also Asendorpf, 1990; Schmidt & Fox, 1999). Of note, this is conceptually distinct from another type of social withdrawal best characterized as disinterest in social engagement (i.e., social disinterest). Recent research has enhanced our understanding of the different motivations that give rise to separable types of social withdrawal (the bulk of which has focused on shyness), but little work has yet examined how components of shy children's developing emotion regulation skill may influence their behavior with peers.

Shy children's behaviors in social contexts can be viewed as attempts to regulate negative emotion or distress, and whether they regulate this distress effectively or not has implications for social adjustment and also the development of anxiety disorders

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(Biederman, Hirshfeld-Becker, Rosenbaum, Herot, Friedman, Snidman, et al., 2001; Ollendick & Hirshfeld-Becker, 2002). Increasingly, adaptive emotion regulation is defined as children's reactions to distress that include effective behavioral and physiological responding to challenge, whereas maladaptive patterns of responding to distress characterize emotion dysregulation (Cole, Martin, & Dennis, 2004). Maladaptive patterns of emotion regulatory functioning have been linked to a host of undesirable outcomes such as difficulties with emotional and social competence (e.g., Blandon, Calkins, & Keane, 2010). In peer contexts, shy children's behaviors should be influenced by individual differences in two aspects of emotion regulation: children's own physiology, and the broader environmental context of parenting. This study investigated the relation between shyness and behaviors during a free play with unfamiliar peers, and how this association may be moderated by individual differences in cortisol regulation and maternal emotion socialization.

Shyness and Social Behavior

Adaptive and maladaptive regulatory behavior

Effective emotion regulation in school-age children comprises both behavioral and cognitive strategies for managing negative emotion (Cole et al., 2004). Because social interaction with unfamiliar peers constitutes a distressing event for shy children, their behavior during these interactions arguably represents regulatory strategies employed to alleviate the distress. Shy children are less likely to play socially, so examining different non-social play behaviors may provide insight into shy children's regulation. Shy children can engage in reticent behavior like watching other children play without initiating interaction; alternatively they can engage in solitary passive play, like coloring a picture or playing alone with a toy. Reticent behavior is a robust behavioral marker for shyness and social anxiety (e.g., Rubin, Burgess, & Hastings, 2002), so shy children who engage in this behavior may be less able to effectively regulate their distress. In contrast, shy children who engage in solitary passive play may be in possession of greater regulatory competence because this behavior is potentially an adaptive strategy for coping with shyness (Henderson, Marshall, Fox, & Rubin, 2004). This reasoning is consistent with research showing that behavioral distraction (e.g., getting involved in another activity to distract oneself from the emotion-eliciting event) is an effective strategy for alleviating negative emotion even among five- and six-year-olds (Davis, Levine, Lench, & Quas, 2010).

An overreliance on maladaptive or ineffective emotion regulation strategies may carry consequences for shy children's broader social functioning. Shy behavior has been linked to problems with social adjustment (Rubin et al., 2002) or internalizing psychopathologies and social anxiety disorder (Biederman et al., 2001; Ollendick & Hirshfeld-Becker, 2002; Rubin & Mills, 1988). Shy behavior can also negatively influence children's peer relationships, as lower perceived social competence can interfere with friendship formation (Blandon et al., 2010). Withdrawal from social interactions with peers can lead to peer rejection (Gazelle & Ladd, 2003), and this can have cyclic effects, as the failure to develop social skills can lead to further withdrawal and peer rejection (e.g., Nelson, Rubin, & Fox, 2005).

A better understanding of shy children's effective and ineffective emotion regulatory behaviors would help identify which shy children are truly at risk for developing social anxiety problems. Rubin and colleagues (Rubin, Coplan, Fox, & Calkins, 1995) highlighted the importance of considering children's emotion regulatory abilities in conjunction with individual differences in shyness by showing that shy preschool children with poorer emotion regulation manifested more internalizing symptoms. Two aspects of children's developing emotion regulatory abilities were expected to moderate shy children's behavior in social contexts (e.g., their behavioral attempts to regulate distress): children's cortisol

regulation (i.e., physiological recovery from stress indexed by how quickly cortisol declines after a social context), and maternal emotion socialization (i.e., mothers' supportive and non-supportive reactions to children's negative emotions).

Shyness and physiological functioning

Shyness has been linked to irregular cortisol patterns, both at resting levels and when coping with a stressor. Shy children typically exhibit higher basal and more reactive cortisol (Essex, Klein, Slattery, Goldsmith, & Kalin, 2010; Granger, Stansbury, & Henker, 1994; Perez-Edgar, Schmidt, Henderson, Schulkin, & Fox, 2008). Four-year-old children rated by mothers as more shy exhibited higher morning salivary cortisol levels (Schmidt, Fox, Rubin, Sternberg, Gold, Smith, & Schulkin, 1997). Similarly, high basal cortisol levels at age 4 have been associated with greater social reticence (observed behavior) among boys identified as temperamentally reactive in toddlerhood (Perez-Edgar et al., 2008), and seven-year-olds who described themselves as highly socially competent showed faster cortisol recovery to baseline after a social stressor (a self-presentation task; Schmidt, Fox, Sternberg, Gold, Smith, & Schulkin, 1999). Chronic activation of the stress response system to social contexts may lower the threshold (or "set point") at which a physiological response is mounted, and decrease the speed with which children recover physiologically. That is, the stress response system may be more readily activated, and slower to recover to pre-stress levels, for shy children (citation omitted for blind review, in press; Lupien, Ouellet-Morin, Hupach, Tu, Buss, Walker, et al., 2006; Rosen & Schulkin, 1998). There may be individual differences in how quickly shy children are able to attenuate this physiological response, and it is not yet known whether this is associated with shy children's play behavior.

Despite mounting evidence of the link between cortisol and shyness, not all laboratory studies find associations between cortisol and children's behavior. One explanation is the lag between the experience of a stressor and the subsequent surge of stress hormones into the bloodstream approximately 20 minutes later (Gunnar & Talge, 2008; Gunnar & Adam, in press). Children's cortisol typically is assessed first at the start of the lab visit, so what is actually measured is the response either to coming to the laboratory or whatever may have happened 20 minutes earlier—not a true baseline of neutral affect and physiological arousal. Thus, a more valuable measure of cortisol during a lab visit may be the change in cortisol indexing the regulation of distress rather than using the increase from the first sample to calculate reactivity (Schmidt et al., 1999). To capitalize on this, the present study focused on cortisol regulation, characterized as the magnitude of the change between a cortisol sample taken immediately post-task (after a peer free play session) and a subsequent sample taken at the end of the visit.

Shyness and maternal emotion socialization

Mothers have myriad opportunities to socialize children's emotional and social functioning. Their reactions to children's negative emotions like sadness, anger, and fear are one especially important avenue by which children learn about appropriate (or at least, normative) reactions to negative emotions and distress. These can be broadly categorized as supportive or non-supportive reactions (e.g., Fabes, Poulin, Eisenberg, & Madden-Derdich, 2002). Supportive responses include comforting, suggestions for problem solving, or active coping with the situation, whereas non-supportive responses include punishing, becoming similarly distressed, or endorsing minimizing reactions. So, if a child were to become distressed by a social situation like playing with unfamiliar children on a playground, a mother could react supportively, by suggesting ways her child could interact effectively with the unfamiliar children (problem solving), or she could react non-supportively, perhaps by telling her child to stop being silly and just go over to the other children (minimizing). Because coping with negative emotion is a harder task for young children than coping with

positive emotion (Ramsden & Hubbard, 2002), the tendency for mothers to respond to their children's negative emotions with supportive or non-supportive strategies is likely to influence children's developing emotion regulation skill (Calkins & Hill, 2007; Thompson & Meyer, 2007).

Bolstering this view is a literature that has examined how these reactions shape children's emotionality and emotion regulation (for a review, see Eisenberg, Cumberland, & Spinrad, 1998). Supportive maternal reactions are positively associated with better emotion understanding and better social outcomes (McElwain, Halberstadt, & Volling, 2007), and the inverse has been shown for non-supportive reactions. Endorsement of more non-supportive reactions has been linked to children's use of ineffective avoidant coping strategies and lower levels of social competence in elementary school (Eisenberg, Fabes, & Murphy, 1996). Similar negative patterns have been found in observations of family interactions (Lunkenheimer, Shields, & Cortina, 2007), and school contexts (Jones, Eisenberg, Fabes, & MacKinnon, 2002).

Few if any studies have yet examined maternal emotion socialization as a putative moderator of the link between shyness and social behavior. But, work has examined the moderating role of other maternal behaviors in the link between early fearful temperament or shyness and later social problems (e.g., Rubin et al., 2002). For instance, the link between shyness and social maladjustment in kindergarten is stronger when mothering is characterized by non-supportive traits or behaviors (e.g., overprotectiveness, neuroticism) but weaker for children with more supportive mothers (e.g., authoritative parenting style, agreeableness) (Coplan, Arbeau, & Armer, 2008) Similarly, Crockenberg and Leerkes (2006) showed that early fearful temperament was linked to later anxious behavior, but only when mothers were less supportive. Thus, mothers' reliance on non-supportive or supportive responses to their children's negative emotion may be linked to children's ineffective and effective emotion regulation, respectively, but this has not yet been tested empirically.

The Present Study

As this literature review illustrates, shyness can be costly. Not all shy children experience problems with social functioning or psychopathology, however, potentially because they are more capable of mitigating distress in social contexts. The present study was designed to investigate two aspects of emotion regulation that were expected to moderate the link between shyness and adaptive or maladaptive social behavior. Mother reports, child cortisol, and observations of children's behavior during a laboratory free play with unfamiliar peers were integrated. Kindergarten-age children were selected because interactions with peers and the social contexts afforded by meeting new friends typically become more common at this stage of childhood. This exposure to new and unfamiliar peers might be especially stressful for shy children, and would potentially reveal individual differences in how children cope.

We had three sets of predictions. First, we expected children to engage in less social play (and more non-social play) if they were rated by mothers as being more shy, consistent with prior research findings (e.g., Coplan et al., 2004). Two kinds of non-social play were of particular interest: shy/reticent behavior (e.g., standing at the edge of a play group, watching but not interacting) and solitary passive play (e.g., playing contentedly alone). These behaviors, respectively, represent ineffective and effective strategies to regulate distress arising from social interaction. The second set of predictions focused on the moderating role of children's physiological functioning, as indexed by salivary cortisol change after a peer free play episode. We expected that shy children whose cortisol levels did not decline after experiencing the social stressor (a dysregulated pattern) would engage in more maladaptive

non-social play like reticent behavior. We also predicted that shy children with changes in cortisol that indicate better physiological regulation (steeper decline after the social stressor) would engage in more adaptive non-social behaviors, like solitary passive play. The third set of predictions concerned the moderating role of mothers' emotion socialization (i.e., mothers' endorsement of supportive and non-supportive reactions to children's negative emotions). We expected shy children whose mothers more strongly endorsed non-supportive reactions to engage in more maladaptive non-social play, and shy children whose mothers endorsed supportive reactions would engage in more adaptive non-social play behaviors. We explored how these moderators related to social play but did not have specific predictions about what might be revealed. Social play was included to provide evidence that expected effects were specific to non-social play. Thus, examination of direct and moderated effects on non-social play behaviors was expected to provide particular insight into shy children's social functioning. In addition to these hypothesized relations, we examined the interactions of cortisol change and emotion socialization predicting each type of play. We did not posit specific predictions about these relations, but included them in analyses to establish that the expected links between physiology, emotion socialization, and social behavior were uniquely related to shyness.

Method

Participants

79 children, drawn from a larger study of emotion development, participated in a laboratory peer visit in the spring of the kindergarten year. 66 (29 girls, M_{age} = 6 years 2 months, SD = 0.31, *range* = 5.5 to 6.75 years) gave at least one usable cortisol sample during the peer visit and are the focus of this study. This subsample was predominantly middle-class (M Hollingshead = 47.31; SD = 10.89; *range* = 17–66) and non-Hispanic European American (97% European American, non-Hispanic, 1.5% Hispanic, 1.5% Asian-American). Participating children were from families composed primarily of married parents (7.6% divorced or single-parent families).

Procedure

Adult reports—Parents (86% mothers, hereafter referred to as mothers) completed questionnaires during the fall of the kindergarten year[1] assessing their child's shyness (Child Social Preference Scale) and their hypothetical reactions to their child's negative emotions (Coping with Children's Negative Emotions Scale).

Peer group laboratory visit—In the spring, children came to the lab for a small peer group visit that lasted 30–40 minutes and was structured so that participants were placed with two or three unfamiliar, same-aged, same-gendered peers[2]. To ensure children did not know one another, groups were composed of children living in different school districts. Families received a modest honorarium for participation in the peer group visit (and children selected a small prize at the end). During the visit, children engaged in free play, helped do a card sorting task, and then took turns describing their most recent birthday. Visits were videotaped for offline coding of behaviors. The peer free play session is the focus of this study. This entailed 15 minutes of unstructured play time in a room with the other children

[1]Independent t-tests compared mothers' (n = 57) and fathers' (n = 9) reports of children's shyness or their own emotion socialization reactions. No differences in shyness or supportive socialization were detected, ts < 1.0, ps > 0.35, but fathers endorsed non-supportive reactions to children's negative emotions at a higher rate (M = 3.00, SD = 0.54) than mothers (M = 2.56, SD = 0.57), $t(64) = 2.12$, $p < .05$.

[2]Peer groups consisted of 3 or 4 children who were usually study participants. If scheduling conflicts prevented formation of groups of study participants, community participants were recruited. Community participants were included in 7 of 22 peer groups (32%) reported here.

(no adults). Age-appropriate toys (e.g., board games, jump ropes, hula hoops) were available and children were instructed to play however they liked while the experimenter was gone. Cortisol was collected from children at three points: Immediately upon arriving at the lab (sample 1; not examined in this study), after the free play (sample 2), and 20 minutes after the end of the visit (sample 3; mothers collected and mailed back to the laboratory).

Stimuli and Measures

Coping with Children's Negative Emotions Scale (CCNES)—Mothers' typical reactions to their children's negative emotion were assessed using the CCNES (Fabes, Eisenberg, & Bernzweig, 1990), which comprises 12 vignettes in which children encounter a range of emotional challenges (e.g., becoming embarrassed in front of friends, feeling afraid of receiving an inoculation) and experience negative emotion. This measure has six subscales, three indexing supportive reactions to children's emotional distress (i.e., expressive encouragement, emotion-focused reactions, and problem-focused reactions) and three indexing non-supportive reactions (i.e., punitive, minimization, and distress responses). After each hypothetical scenario, mothers rate how likely they would be to react to the child's distress with an action or behavior representing each of the six subscales on a 7-point scale (1 = very unlikely, 7 = very likely). For example, one vignette reads, "If my child is shy and scared around strangers and consistently becomes teary and wants to stay in his/her bedroom whenever family friends come to visit, I would: (a) help my child think of things to do that would make meeting my friends less scary (*problem-focused*), (b) tell my child that it is OK to feel nervous (*expressive encouragement*), (c) try to make my child happy by talking about the fun things we can do with our friends (*emotion-focused*), (d) feel upset and uncomfortable because of my child's reactions (*distress*), (e) tell my child that he/she must stay in the living room and visit with our friends (*punitive*), (f) tell my child that he/she is being a baby (*minimization)*." Subscales are computed by summing the likelihood of responding each way to each vignette and dividing by twelve. This measure has adequate internal consistency, test-retest reliability and construct validity, according to published reports of its psychometric properties (e.g., Eisenberg & Fabes, 1994), and the internal consistency for the supportive (Cronbach's alpha range: 0.76– 0.90) and non-supportive (Cronbach's alpha range: 0.71–0.84) scales in this study were good.

Child Social Preference Scale (CSPS)—Mothers also completed the *Child Social Preference Scale* (CSPS; Coplan et al., 2004). This measure has two subscales that tap distinct aspects of children's play motivation: *Shyness* (seven items) and *Social Disinterest* (four items). Because of our specific interest in children's shyness, we did not include the *Social Disinterest* scale in this investigation. Mothers rated how much each item was like their child on a 5-point scale (1 = not at all, 5 = a lot) and these ratings were summed and divided by seven to create an average shyness score. Example items from the *Shyness* scale include, "My child seems to want to play with other children, but is sometimes nervous to," and, "Although he/she appears to desire to play with others, my child is sometimes anxious about interacting with other children." Internal consistency of this measure in the present study was excellent, $\alpha = 0.87$ and comparable to other published reports (Cronbach's alphas 0.86–0.89) that have shown acceptable reliability and validity for this measure (Coplan et al., 2004).

Determination of cortisol—Cortisol was collected from children in the laboratory by having them chew on braided cotton dental rolls until thoroughly saturated. To encourage compliance, children were allowed to mouth the cotton roll after dipping it into sugar crystals. Trained research assistants collected the first two samples, secured the cotton rolls in airtight, sealed conical tubes, kept them cold until the end of the visit, and froze them at −50°F until they were shipped for assay. Mothers collected the last cortisol sample

approximately 20 minutes after leaving the laboratory and refrigerated the sample at home until mailing back to the laboratory. Saliva samples were transported on ice to the Behavioral Endocrinology Laboratory at Penn State University, where they were stored frozen at −80°C until assayed (Salimetrics, State College, PA). On the day of cortisol assay, samples were centrifuged at 3000 rpm for 15 minutes to remove mucins. Samples were assayed for salivary cortisol using an enzyme immunoassay US FDA (510), cleared for use as an in vitro diagnostic measure of adrenal function (Salimetrics). The test used 25 μL of saliva, had a range of sensitivity from .007 to 3.0 μg/dL, and average intra- and inter-assay coefficients of variation less than 5% and 10%, respectively.

Coding and Data Reduction

Behavioral scoring—Free play sessions were coded by trained research assistants for types of play using the Play Observation Scale coding scheme (Rubin, 2001). This includes a wide range of play and non-play behaviors, but of particular interest were *Social play*, *Solitary passive play*, *Reticent* (unoccupied, onlooking), and *Hovering* behaviors. For all of these except *Hovering*, coders scored the predominant play behavior in 10 second epochs and only one behavior was coded for each epoch. Following Rubin's recommendations, when multiple play behaviors occurred within a single epoch, the behavior observed for the majority of the epoch was coded as predominant. If two behaviors occurred for the same amount of a given epoch, a hierarchical scheme was adopted such that codes for social play were assigned over solitary play, making our assessment of children's non-social behavior fairly conservative. *Social play* was coded when the child was playing with the other children and the group appeared to have a common goal or purpose. *Social play* included any instance of seven behaviors that were group-related (e.g., group game-playing, group constructive play), each of which we coded separately but then collapsed into the single *Social play* code. Solitary play was coded when the child was playing alone a few feet away from the other children, usually with different toys than the rest of the group. The child was focused on his or her own activity and paying little attention to the others. *Solitary passive play* was a collapsed code made up of any instance of solitary exploration or solitary constructive play. Unoccupied behavior was coded when children were staring blankly or wandering without apparent purpose. Onlooking behaviors included watching other children from a distance (e.g., more than 3 feet away) without joining in their activity. Following Rubin and colleagues (e.g., Coplan, Rubin, Fox, Calkins, & Stewart, 1994; Rubin et al., 2002) we collapsed these two behaviors into a single *reticence* code made up of any instance of unoccupied or onlooking behavior. Proportion scores were computed for each behavior (i.e., the number of epochs in which each behavior was predominant was divided by the total number of codable epochs).

Hovering was coded in a second pass through the data and could co-occur with the predominant behaviors described above. Hovering behaviors were defined as onlooking behaviors within three feet of another focal child in which participants appeared as though they wanted to join in but appeared to be wary (e.g., onlooking at close proximity), again following Rubin's guidelines. *Hovering* was computed as the proportion of codable epochs in which hovering behavior was predominant. Reliability for social play, solitary passive play, and reticent behaviors was calculated among coders on approximately 12% of cases and found to be adequate (inter-rater agreement = 93%; average $\kappa = .61$ for the complete variable matrix). Reliability for hovering behavior (coded in a separate pass) was computed as an intra-class correlation and was good (ICC = 0.78).

Data transformation—Raw cortisol values were positively skewed and log transformed. Laboratory visits took place in mornings, afternoons, or evenings, so to account for time of day in cortisol analyses we extracted the residuals from an analysis in which the initial

cortisol value (i.e., the sample taken immediately after the free play) was regressed on time of day. We then computed a residualized change score (a standardized score with a mean of zero and standard deviation of one) representing each child's relative physiological recovery from the peer free play by regressing the post-visit sample (non-transformed $M = 0.061$, $SD = 0.027$) on the time-corrected initial cortisol level (non-transformed, non-time-corrected $M = 0.063$, $SD = 0.040$) and extracting the standardized residuals for use in analysis. Thus, the cortisol regulation value represented the change in cortisol subsequent to the free play, controlling for initial level and time of day. Negative values indicate a faster decline or more negative slope and suggest effective regulation, whereas positive values indicate a non-declining slope that suggests cortisol dysregulation (lack of recovery from social stressor).

Observed behavior with peers—*Social play* ($M = 0.41$, $SD = 0.20$) and *solitary passive play* ($M = 0.09$, $SD = 0.15$) proportions were standardized before analysis. A composite was created to index shy/reticent behavior in the peer free play visit. The proportion scores for hovering ($M = 0.004$, $SD = 0.01$) [3] and reticent behavior ($M = 0.12$, $SD = 0.13$)during the free play were standardized and summed to form a composite variable of shy/reticent behavior during the peer free play. This composite was used in all analyses. Solitary passive play and the shy/reticent composite were both positively skewed. Because of this, the proportions of solitary passive play, hovering, and reticent behavior were each square-root transformed before standardization. Analyses with transformed data resulted in an identical pattern of results, so for ease of interpretation we present findings using the non-transformed dependent variables below.

Results

Preliminary Analyses

Analysis of missing data—Listwise deletion of cases without complete data is increasingly recognized as problematic (i.e., it has been shown to bias parameter estimates and unnecessarily limit power; Howell, 2007; Widaman, 2006), so we chose to impute missing data for the 66 children who provided at least one useable cortisol sample during the visit. Specifically, we imputed missing cortisol values (all 66 children had complete data for mother-report of child shyness and mother self-reports of emotion reactions). Forty-four children (67%) had complete cortisol data from the two time points, 10 children (15%) were missing only the sample mailed back by parents, 2 children (3%) were missing only the second sample collected in the lab, and 4 children (6%) were missing both samples of interest (thus had provided usable cortisol at the beginning of the visit, which are not examined here). We applied the Missing Value Analysis in SPSS to the data to assess the pattern of missing data, Little's MCAR χ^2 (7) = 9.80, $p = 0.20$, suggesting that missing cortisol data were likely missing completely at random. Cortisol data was thus imputed using the expectation/maximization (EM) algorithm because this method has been recommended over other methods like mean substitution or listwise deletion (e.g., Howell, 2007; Jeličić, Phelps, & Lerner, 2009). We compared the 66 children included in this study to the 13 other children who participated in the peer visit but provided no usable cortisol on maternal-report of shyness (CSPS), and supportive and non-supportive reactions to children's emotions (CCNES). There were no group differences on any variable, ts(77) < 1.16, ps > 0.25, suggesting that children who were and were not included in the present study did not differ significantly on key variables.

[3] *Hovering* was observed for only 14% of children. But, because of our hypotheses specific to shy children's use of ineffective regulatory behaviors (i.e., reticent behavior) with peers, we included it in our shy/reticent composite. We replicated all primary analyses with hovering excluded from the composite and obtained an identical pattern of results, so for conceptual reasons we include it in the results presented here.

Gender differences—We explored gender differences in key variables (i.e., mother-reported child shyness, cortisol dysregulation, mother-report of supportive and non-supportive reactions to emotion, and observations of play behavior in the laboratory). No differences emerged, all *t*s < 1.51, *ps* > 0.14, so gender was not considered further.

Size of play group—Children participated in 3- or 4-person same-sex play groups ($n = 27$ in 3-person groups; $n = 39$ in 4-person groups). Because the size of the group may have affected play behavior, we compared play (social play, solitary passive play, and shy/reticent behavior) that was observed in 3- versus 4-person groups and found no differences, *t*s < 1.0, *p*s > 0.32.

Descriptive statistics—Bivariate correlations and descriptive statistics for all study variables are presented in Table 1. Child shyness, as indexed by mother report, was negatively associated with social play but positively associated with shy/reticent behavior and solitary passive play during the free play session. Greater cortisol dysregulation (i.e., a smaller or less steep decline indicating that cortisol remained elevated after the free play) was also positively associated with child shyness, supporting our argument that this social context may represent a stressor for shy children. Of note, mothers' self-reported supportive (*range* = 3.89–6.81) and non-supportive (*range* = 1.61–3.94) reactions to children's (hypothetical) negative emotions did not relate to child shyness, cortisol dysregulation, or play behaviors. Somewhat surprisingly, supportive and non-supportive reactions were not inversely related, suggesting that mothers endorse a blend of responses to children's negative emotions in daily life.

Moderators of the Relation between Child Shyness and Play Behavior

Overview—We conducted three hierarchical regression analyses. Each examined child shyness, cortisol dysregulation, and supportive and non-supportive maternal emotion reactions as predictors of children's play behavior (three separate models tested the effects of these predictors on social play, shy/reticent behavior, and solitary passive play). In each model, the four independent predictors were entered in Step 1, the five two-way interactions (i.e., shyness X cortisol dysregulation, shyness X supportive reactions, shyness X non-supportive reactions, cortisol dysregulation X supportive reactions, and cortisol dysregulation X non-supportive reactions) were entered in Step 2 (variables were centered before inclusion in interaction terms).

Child shyness, cortisol dysregulation, and maternal emotion reactions—Model statistics for regression analyses are presented in Table 2. The first regression examined social play during a free play with unfamiliar peers. The only significant predictor of social play was child shyness. As expected, children rated as more shy engaged in less social play. No other effects emerged from this model.

The second model examined shy/reticent behavior during the free play. This showed a main effect of mother-reported shyness predicting shy/reticent behavior in the expected direction, but this effect was qualified by two 2-way interactions. The first, shyness X cortisol dysregulation, is depicted in Figure 1. We probed this interaction by calculating the simple slope of shyness predicting solitary play at low and high values of cortisol dysregulation (i.e., recentered at +/− 1SD from mean). This indicated that mother-reported shyness was unrelated to shy/reticent behavior when children had low levels of cortisol dysregulation, $\beta = 0.04$, $t = 0.31$, *n.s.*, but was positively associated with shy/reticent behavior when children had high levels of cortisol dysregulation, $\beta = 0.57$, $t = 5.50$, $p < .001$. In line with our predictions, cortisol dysregulation moderated the link between mother-reported shyness and children's shy/reticent behavior in the lab. The second interaction, between mother-reported

shyness and non-supportive emotion reactions, is shown in Figure 2. We probed this by calculating simple slopes of shyness predicting behavior at high and low levels of non-supportive emotion reactions. Consistent with our predictions, shyness was positively associated with shy/reticent behavior when mothers reported higher levels of non-supportive reactions to children's negative emotions, $\beta = 0.65$, $t = 5.69$, $p < .001$, but there was no relation when mothers reported lower levels of non-supportive reactions, $\beta = -0.04$, $t = -0.28$, *n.s.* Thus, maternal non-supportive reactions to children's emotions also moderated the link between mother-reported shyness and children's shy/reticent behavior with unfamiliar peers.

The third model examined solitary passive play. When the fully saturated model was tested, it was not significant, so we trimmed the two interactions that were least strongly predictive of solitary passive play (as determined by inspecting the standardized beta values: shyness X non-supportive reactions and cortisol dysregulation X non-supportive reactions). We then reran the model with all main effects and the other three two-way interactions. This trimmed model was significant and is presented in Table 2. Child shyness was positively related to greater solitary passive play, but two 2-way interactions qualified this. Child shyness X cortisol dysregulation is shown in Figure 3. Note that this interaction was marginal ($p = .058$), but probed and described here because of our specific predictions about cortisol dysregulation. Simple slopes analysis showed that maternal-reported shyness was positively associated with solitary passive play when children had low levels of cortisol dysregulation (i.e., were better physiologically regulated), $\beta = 0.47$, $t = 2.79$, $p < .01$; but shyness was not related to solitary passive play when children had higher levels of cortisol dysregulation, $\beta = 0.08$, $t = 0.56$, *n.s.* In support of our predictions, shy children engaged in more solitary passive play only when they also had better cortisol regulation. The second interaction was between shyness and supportive (hypothetical) maternal reactions to children's negative emotions (Figure 4). Probing the simple slopes indicated that shyness was positively associated with solitary passive play when mothers reported a higher level of supportive reactions, $\beta = 0.55$, $t = 2.74$, $p < .01$, but there was no relation when mothers reported a lower level of supportive reactions, $\beta = 0.00$, $t = 0.01$, *n.s.* Taken together, these findings support our predictions and suggest that solitary passive play may represent an adaptive strategy for shy children to use in order to alleviate distress resulting from a free play session with unfamiliar peers.

Discussion

This investigation sought to enhance our understanding of shy children's behavior with peers by examining two moderating aspects of emotion regulation (physiological regulation and maternal emotion socialization). This is one of few studies to employ a multi-method approach to characterize shy children's behavior with peers. We also examined different play behaviors children engaged in during a free play session as indices of effective or ineffective attempts to regulate negative emotion arising from a social interaction. We examined two kinds of non-social play: shy/reticent behavior (e.g., standing at the edge of a play group, watching but not interacting) and solitary passive play (e.g., playing contentedly alone), representing ineffective and effective strategies to regulate distress, respectively. We predicted that shy children's behavior with peers would be moderated by cortisol regulation and maternal emotion socialization.

As predicted, children engaged in less social play (and more non-social play) if mothers rated them as being more shy, consistent with prior research findings (e.g., Coplan et al., 2004). Shy children also showed more shy/reticent behavior with peers (e.g., Rubin et al., 2002). Greater shyness was also related to engaging in more solitary passive play. Thus, children who were rated as more shy by their mothers appeared not only to be engaging in

less social play, but more of both the non-social play behaviors. This general pattern supports our argument that these behaviors represent adaptive and maladaptive behavioral emotion regulatory strategies. Reticent behavior is a fairly robust behavioral marker for shyness and social anxiety (e.g., Rubin et al., 2002) that involves watching others play without making overtures to join in, whereas solitary passive play involves playing alone and is similar to behavioral distraction. Shy children may engage in reticent behavior because they are less able to effectively regulate their own distress that arises from the social interaction. In contrast, solitary passive play (as a form of behavioral distraction) would be an effective means of alleviating negative emotion even among five- and six-year-olds (Davis et al., 2010; Henderson et al., 2004). Shy children who engaged in more solitary passive play, thus, appeared to possess greater regulatory competence relative to shy children who engaged in reticent behavior with peers.

Cortisol Dysregulation and Behavior with Peers

We hypothesized that cortisol regulation would moderate the relation between shyness and behavior with peers, and results supported this. Specifically, children who were rated as more shy with greater cortisol dysregulation (i.e., recovered more slowly after the peer interaction), exhibited the most shy/reticent behavior. Shy children with faster cortisol recovery, however, engaged in more solitary passive play. Although the latter finding was marginal, the pattern of results is consistent with predictions and suggests that shy children with better physiological regulation engaged in effective behavioral strategies to regulate distress during the free play by playing alone. Taken together, these findings suggest that shy children with a more dysregulated physiological profile possess fewer regulatory resources to manage distress, and thus engaged in ineffective behavioral strategies like onlooking and hovering without interacting with other children. This pattern indicates that shy children with better physiological regulation were able to choose more adaptive behaviors, but an equally plausible alternative interpretation is that choosing to play alone (an effective strategy) led shy children to experience a quicker physiological recovery after the free play ended. Either way, though, these findings indicate that shy children's cortisol regulation is associated with the effectiveness of the behavioral regulation strategies used during a social interaction.

Of note, this is one of only a handful of studies that have focused on stress dysregulation in the form of recovery after a stressor. Our findings complement existing links between shyness and stress reactivity by showing that physiological dysregulation is not limited to initial reactivity, but encompasses recovery from stress as well. A key strength of this approach is that it allows researchers to avoid the common problem of laboratory 'baseline' assessments actually measuring anticipatory reactions instead of a true basal level.

Maternal Emotion Socialization and Behavior with Peers

We also found evidence for the moderating role of maternal emotion socialization. This supports the idea, consistent with previous work, that the way mothers react to children's negative emotions shapes children's developing regulatory abilities. Somewhat surprisingly, supportive and non-supportive reactions were not inversely related in this study. This indicates that mothers likely endorsed a blend of responses to children's negative emotions, rather than consistently reacting in supportive or non-supportive ways. In general, mothers in this sample did not report a very high likelihood of using non-supportive strategies. Yet, for shy children, mothers' endorsement of a relatively high level of non-supportive strategies was related to greater shy/reticent behavior. But, when shy children's mothers endorsed a high level of supportive strategies, these children engaged in more adaptive solitary passive play. Thus, similar to our cortisol findings, shy children engaged in more effective regulatory behaviors when they had more emotion regulation resources (i.e., supportive

reactions from mothers), but less effective regulatory behaviors when they had fewer resources (i.e., non-supportive reactions from mothers). Our findings highlight the importance of accounting for parenting strategies that socialize emotion understanding and emotion regulation when studying children's behavioral regulatory abilities (e.g., Calkins & Hill, 2007; Eisenberg et al., 1998).

Of note, maternal emotion socialization did not relate directly to mother-reported child shyness or children's behavior during the peer free play. Thus, an alternate explanation for our findings is that mothers react with non-supportive reactions when they perceive their children as shy and likely to engage in shy/reticent behavior around other children. That is, mothers may be responding to children's ineffective behaviors with non-supportive reactions that further exacerbate these children's difficulties with emotion regulation. Conversely, mothers may react with supportive strategies when they perceive their child to be shy but capable of effectively coping with the distress. The cross-sectional design of our investigation means we cannot determine which of these explanations is correct, but both speak to the importance of including maternal emotion socialization in examinations of shy children's behavior with peers and emotion regulation abilities.

Implications for Children's Broader Social Competence

Taken together, our findings shed light on the pernicious, cyclical nature of problematic shyness that can lead to peer rejection, further social withdrawal, or in extreme cases, anxiety problems (Biederman et al., 2001; Blandon et al., 2010). Once a context is perceived as potentially threatening, children manage the ensuing distress by drawing on their emotion regulation resources and abilities. If children have fewer resources, like cortisol dysregulation or non-supportive maternal reactions to their distress, they may be unable to select (or implement) effective behavioral strategies like playing alone. Using an ineffective regulatory strategy not only can exacerbate distress in the immediate context (e.g., Gross & Levenson, 1997), but a long-term reliance on ineffective strategies may carry steep consequences for social functioning. Shy behavior has been associated with problems with social adjustment (Rubin et al., 2002) or internalizing psychopathologies and social anxiety disorder (Biederman et al., 2001; Ollendick & Hirshfeld-Becker, 2002; Rubin & Mills, 1988), and can also interfere with peer relationships and friendship formation (Blandon et al., 2010), especially if peers perceive shy children to be less socio-emotionally competent. Although our findings do not extend directly to these domains of functioning, this study is one of the first to highlight the important links among shyness, physiological regulation, and maternal emotion socialization that represent a promising avenue for future research in this area.

Limitations and Future Directions

Some limitations must be mentioned. This sample was taken from a larger longitudinal study and limited to children who participated in the laboratory visit and provided useable cortisol data. This relatively small sample size probably limited statistical power to detect significant effects in the analyses we ran (e.g., the marginal two-way interaction of shyness and cortisol dysregulation predicting solitary passive play). It is noteworthy that we still identified important main and moderating effects, because this suggests that the relations examined in this investigation are robust. Future studies should attempt to replicate these findings in larger multi-method samples.

An additional consideration is the laboratory context. Although the free play was designed to allow children to interact as naturally as possible, children were certainly aware they were participating in a research study. A promising future direction would be to replicate this study in naturalistic play contexts (e.g., recess during the first week of a new school year).

And, it should be acknowledged that we were interested in examining individual children's behavior (coded in separate passes through the data) and not the transactional influence of the group and the child on one another. Another way to approach this type of data would be to examine time-series changes for individuals nested within groups, to determine whether changes in one child's behavior lead to changes in another's. These all represent potentially fruitful avenues of exploration for developmental scientists.

Such questions as were addressed here would also benefit from longitudinal studies designed to examine these developing relations at younger and older ages. We chose this age because children typically have a wide range of emotion regulation strategies available (Davis et al., 2010), and they are beginning to spend more time with peers, but mothers' socialization influence is still salient. Thus, 5–6 year olds were a logical first step into examining these phenomena, but empirical research with younger and older children is needed to determine whether and when the associations reported here are present. For example, as the influence of parents wanes in early adolescence and peers become the primary socializing agents, we would expect maternal emotion socialization to play less of a moderating role in shaping shy children's behavior. Longitudinal studies would help pinpoint potential intervention opportunities aimed at helping mothers learn which emotion responses and regulatory approaches are most effective for helping children learn to deal with their feelings adaptively.

Conclusion

The present investigation contributes to our knowledge of children's shyness. This study is one of the first to provide evidence that different kinds of non-social play behavior may represent adaptive and maladaptive behavioral emotion regulation strategies for shy children. We also illustrated the importance of two aspects of developing emotion regulation--children's physiological stress responses and mothers' supportive and non-supportive emotion reactions--in moderating the relation between shyness and these adaptive and maladaptive play behaviors. Identifying this pattern of physiological dysregulation and maternal non-supportiveness that was associated with maladaptive regulatory behaviors among shy children suggests that understanding ineffective emotion regulation among shy children is a potentially fruitful avenue for future research that may shed light on which shy children end up with social adjustment problems, and in extreme cases, psychopathology.

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Figure 1.

Interaction of mother-reported child shyness and cortisol dysregulation predicting Shy/Reticent behavior in the peer visit. Asterisks denote level of cortisol dysregulation with simple slope different from zero (***$p < .001$).

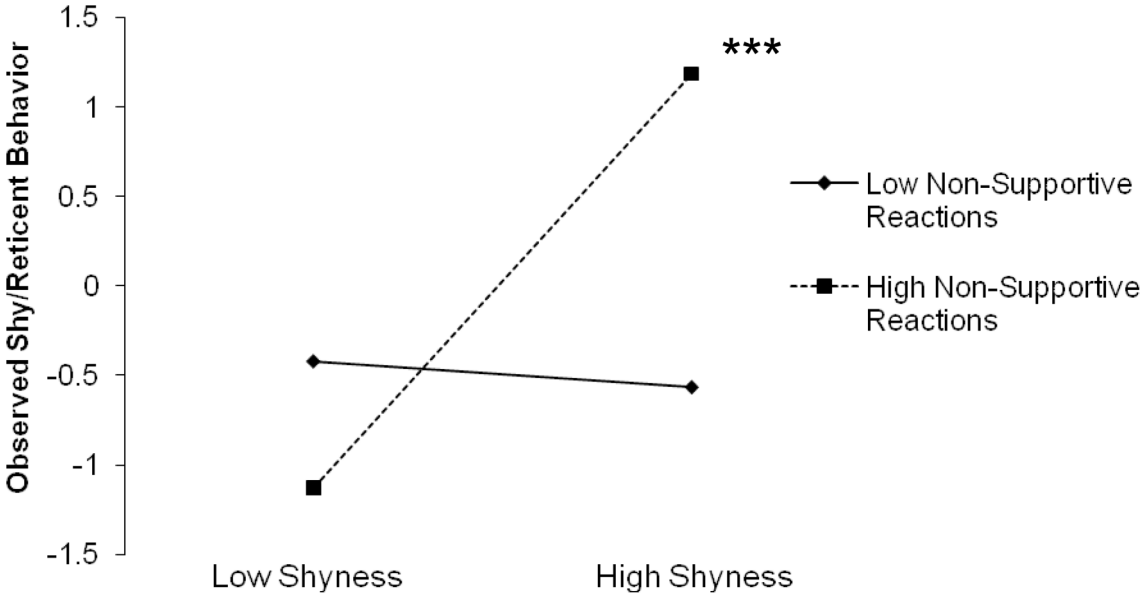

Figure 2.
Interaction of mother-reported child shyness and non-supportive maternal emotion reactions predicting Shy/Reticent behavior in peer visit. Asterisks denote level of non-supportive reactions with simple slope different from zero (***$p < .001$).

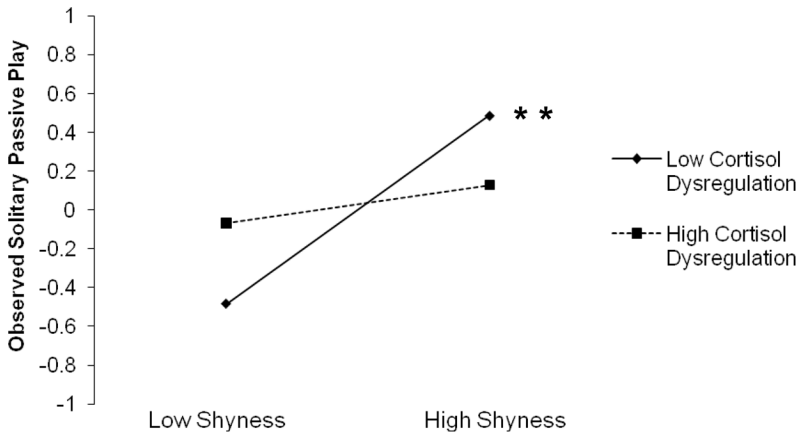

Figure 3.

Interaction of mother-reported shyness and cortisol dysregulation predicting observed Solitary Passive play behavior in the peer visit. Asterisks denote level of cortisol dysregulation with simple slope different from zero (**$p < .01$).

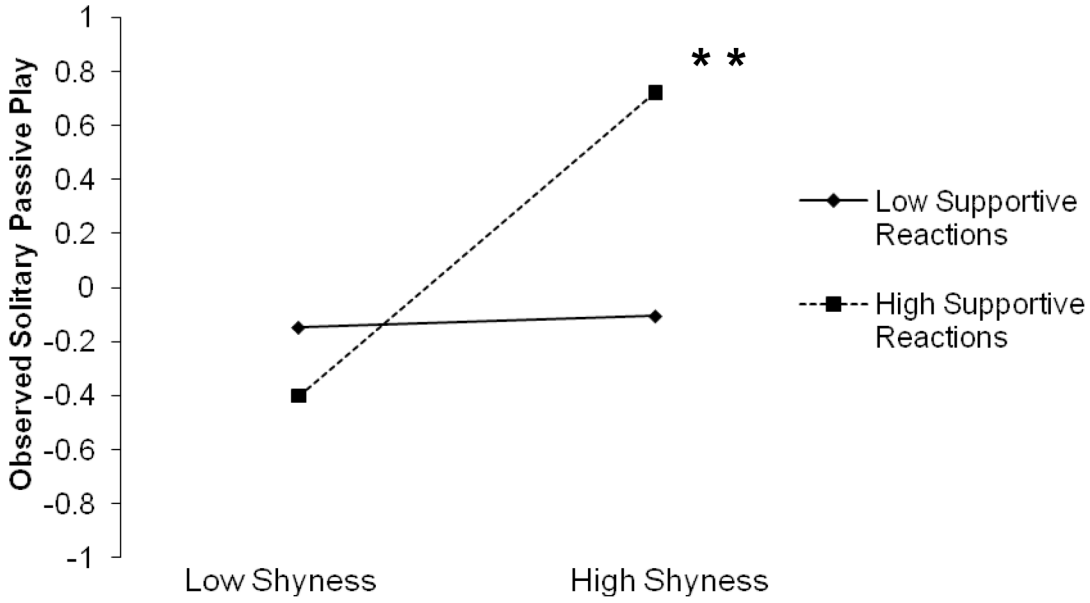

Figure 4.
Interaction of mother-reported shyness and supportive maternal emotion reactions predicting observed Solitary Passive play behavior in the peer visit. Asterisks denote level of supportive reactions with simple slope different from zero (**$p < .01$).

Table 1

Descriptive Statistics (Mean and Standard Deviation) and Bivariate Correlations for Study Variables (n = 66)

		1	2	3	4	5	6	7	8
Maternal Report	*M (SD)*								
1. Child Shyness (CSPS)	**1.94 (0.71)**								
2. Non-supportive Emotion Reactions (CCNES)	**2.62 (0.58)**	0.16							
3. Supportive Emotion Reactions (CCNES)	**5.48 (0.62)**	0.02	−0.14						
Cortisol Regulation									
4. Post-Free Play Sample	**0.06 (0.04)**	0.02	−0.03	0.02					
5. End of visit Sample	**0.06 (0.03)**	0.22^{t}	0.04	−0.07	0.59***				
6. Cortisol Dysregulation: Standardized Residual Change (Sample 2 to 3)	**0.00 (1.00)**	0.25*	0.07	−0.10	0.00	0.81***			
Observed Play Behavior									
7. Social Play	**0.00 (1.00)**	−0.45***	−0.05	−0.13	−0.21^{t}	−0.31*	−0.23		
8. Solitary Passive Play	**0.00 (1.00)**	0.23^{t}	0.10	0.15	0.24^{t}	0.14	−0.00	−0.57***	
9. Shy/Reticent Behavior	**0.02 (1.78)**	0.54***	0.17	−0.11	0.07	0.32**	0.35**	−0.42**	0.02

Note. Raw cortisol values (before natural log transformations) are presented here for ease of interpretation, but the standardized residual change was calculated using transformed cortisol values for both samples (the post-free play sample was also time-of-day-corrected). Social and Solitary Passive play behaviors are standardized within this sample; Shy/Reticent behavior is the sum of standardized Hovering and Reticent behavior.

*** $p < .001$;

** $p < .01$,

* $p < .05$,

^{t} $p < .10$

Table 2

Hierarchical Regression Models of Shyness, Cortisol Dysregulation, and Maternal Emotion Reactions Predicting Observed Play Behavior (n = 66)

	R^2	ΔR^2	ΔF	β	t	p
Model 1: Social Play						
Step 1.	**0.24**	**0.24**	**4.78**			**.002**
Child Shyness				**−0.44**	**−3.51**	**.001**
Cortisol Dysregulation				−0.17	−1.43	.159
Supportive Reactions				−0.11	−0.96	.340
Non-Supportive Reactions				0.01	0.08	.940
Step 2.	0.30	0.06	0.95			.450
Shyness X Cortisol				0.17	1.36	.181
Shyness X Supportive				−0.12	−0.96	.339
Shyness X Non-Supportive				−0.04	−0.31	.757
Cortisol X Supportive				0.15	1.22	.227
Cortisol X Non-Supportive				−0.07	−0.54	.591
Model 2: Shy/Reticent Behavior						
Step 1.	**0.35**	**0.35**	**8.21**			**.000**
Child Shyness				**0.30**	**3.31**	**.002**
Cortisol Dysregulation				**0.16**	**1.79**	**.078**
Supportive Reactions				−0.13	−1.46	.149
Non-Supportive Reactions				−0.15	1.65	.105
Step 2.	**0.62**	**0.27**	**7.92**			**.000**
Shyness X Cortisol				**0.40**	**4.21**	**.000**
Shyness X Supportive				0.05	0.48	.633
Shyness X Non-Supportive				**0.35**	**3.86**	**.000**
Cortisol X Supportive				−0.13	−1.44	.155
Cortisol X Non-Supportive				0.00	0.03	.974
Model 3: Solitary Passive Play						
Step 1.	0.09	0.09	1.42			.237
Child Shyness				**0.29**	**2.33**	**.024**

	R^2	ΔR^2	ΔF	β	t	p
Cortisol Dysregulation				0.02	0.12	.904
Supportive Reactions				0.14	1.21	.233
Non-Supportive Reactions				0.03	0.21	.832
Step 2.	**0.23**	**0.15**	**3.64**			**.018**
Shyness X Cortisol				**−0.28**	**−2.19**	**.032**
Shyness X Supportive				**0.25**	**1.94**	**.058**
Cortisol X Supportive				−0.20	−1.57	.123

Note. Boldface values indicate significant effects or steps of the model. Regression parameters for all predictor variables are given for the full models (at Step 2).